Braden Copper Co.
Chile Pg 3

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THE LOCOMOTIVE WORLD

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THE FRANKLIN TYPE AND PRINTING COMPANY

H. C. Hammack, Editor

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THE FRANKLIN TYPE AND PRINTING COMPANY

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OUR DECREASING EXPORTS AND INCREASING FREE IMPORTS

IN eleven months of the present fiscal year exports from the United States were $9,054,545 less in value than those of the same period in the preceding year, the decrease having been from $2,302,479,233 to $2,207,424,688. In May, 1914, the value was $32,957,219 less than in May, 1913. Should June show an equal decline, the total decrease in the present fiscal year will reach at least $127,000,000.

In the eleven months imports into the United States were $54,123,383 greater in value than those of the same period in the preceding year, the increase having been from $1,681,762,357 to $1,735,885,740. May, 1914, showed an increase in the value of imports over May, 1913, from $133,723,713 to $163,637,386, or by $29,913,673. The increasing tendency of the past few months found striking expression in an increase from $69,006,928 to $102,507,928, or by $33,501,000, equal to 48 per cent., in the value of imports free of duty in May, 1914, as compared with like imports in May, 1913, while there was an actual decrease from $64,716,785 to $61,129,458, or by $3,587,327, in the value of dutiable imports.

Between November 1, 1913, and May 31, 1914, there was a decrease as compared with the same period in the preceding fiscal year of $163,014,016 in value of exports, while the increase in the value of imports was $99,606,902.

Is there occasion to look farther for explanation of the rush to New York within the past few days of millions of dollars of gold to meet the want created by the shipment since May 1 of millions of dollars of gold to Europe?

Indeed, had it not been for cotton and a few other products of agriculture figuring in exports the foreign trade exhibit of the United States in the fiscal year now ending would have been rather a sorry one. Of the total value of exports in the eleven months of the present fiscal year $1,010,634,017, or more than 45 per cent., represented

six groups of exports which had an increase over the same period in the preceding year of $30,-840,807. The changes in the two eleven-month periods are shown in the following table:

	1913	1914
Cotton	$533,072,813	$591,724,524
Breadstuffs	188,113,110	144,117,494
Mineral oils	122,239,525	137,605,198
Meat and dairy products	116,030,504	122,991,079
Cottonseed oil	19,428,085	13,260,706
Cattle, sheep and hogs	909,173	935,016
Total	$979,793,210	$1,010,634,017
All exports	$2,302,479,233	$2,207,424,688

There were decreases in 1914 under 1913 in bread-stuffs from $188,113,110 to $144,117,494 or by $43,995,616, and in cottonseed oil from $19,428,085 to $13,260,706, or by $6,167,379, making a total decrease of $50,162,995, and there were increases in raw cotton from $533,072,813 to $591,724,524, or by $58,651,711; in mineral oils from $122,239,525 to $137,605,198, or by $15,365,673; in meat and dairy products from $116,030,504 to $122,991,079, or by $6,960,575, and cattle, sheep and hogs from $909,173 to $935,016, or by $25,843, the total increase being $81,003,802, and the aggreate increase for the six groups being $30,840,807.

The importance of the South's cotton as a saving factor in the international trade of the United States, even in a year of depression in exports, is emphasized by the fact that nearly 27 per cent. of the aggregate value of exports in the present fiscal year to June 1 was the value of cotton; that of the increase in that value over the eleven months of the preceding fiscal year was more than sufficient to overcome the decrease in the value of exports of bread-stuffs and cottonseed oil, and that that increase constituted more than 70 per cent. of the total increase in the value of exports of the four special groups of products showing increases.—Manufacturers' Record.

MARATHON LUMBER CO.'S NEW MILL AT LAUREL, MISS.

The Marathon Lumber Co., R. C. Schulz, general manager, Laurel, Miss., is progressing with the construction of its big mills, and expects to begin manufacturing by October. Its plant is described as follows:

Sawmill building has concrete foundation, with solid concrete and steel saw floor, but the saw floor is supported by wooden timbers or wooden frame; sides and roof of corrugated galvanized iron, practically fireproof. Main building 72 feet wide and 252 feet long; will be equipped with two single-cutting band saws and two re-saws, one of which will be a horizontal Filer & Stowell re-saw of modern construction, large and heavy, while the other re-saw will be vertical; expect this mill to produce not less than 175,000 feet of lumber in 10 hours. Planing mill 120x120 feet, constructed entirely of concrete, steel and corrugated galvanized-iron sides and roof, equipped with four fast-feed matchers, surfacer, re-saw and 12-inch molder; mill large enough to handle output of sawmill, even though operated day and night, producing about 350,000 feet every day of day and night shift. Boiler-room 64x84 feet, constructed of steel, concrete and corrugated galvanized iron, with 10 72-inch by 18-foot new boilers, manufactured by the Casey-Hedges Company, of Chattanooga, Tenn., capable of developing 1,700 horse-power when operated at a steam pressure of 160 pounds. Engine-room 40x64 feet, constructed entirely of concrete and brick, with steel roof, having an 18x42 Filer & Stowell twin Corliss engine. Fuel-room constructed of brick, steel roof, 40x64 feet; sorting works 51 feet wide and 528 feet long; seven standard dry-kilns, each 20x104 feet, with necessary cooling and sorting sheds; dressed-lumber shed constructed of wood, 128 feet wide and 236 feet long, floor constructed of solid concrete; rough-lumber shed, solid concrete floor, 120x130 feet; loading dock will be 900 feet long, floor of solid concrete; log pond comprises about 12 acres; burner 100 feet high and 38 feet diameter.

Mill site is between the tracks of the N. O. M. & C. R. R. Co. and the N. O. & N. E. R. R. Co., on the west of the N. O. & N. E. Railway and alleyways in the yards will be of concrete and long enough for a stock of about 20,000,000 feet of lumber, in addition to the lumber to be stored in sheds.

This new mill, when completed will be a notable addition to the lumber industry in that section. The up-to-date character of this mill's equipment is well indicated by the arrangements

(Continued on page 13)

THE BRADEN COPPER MINES

By Pope Yeatman

THE MINES of the Braden Copper Co. are situated in the Andes mountains, O'Higgins province, Chile, in about latitude 34 degrees south and 71 degrees, 20 minutes west longitude. The property is reached from Valparaiso, the seaport, by means of a broad-gauge (5 feet 6 inches) road as far as Rancagua a distance of about 158 miles, and from Rancagua by the company's narrow-gauge railroad, the length of which is about 43 1-2 miles to the concentrator and smelter, and 1 1-2 miles farther to the mines.

The mining area consists of 101 claims covering 1214 acres. The legal status of all these claims is reported by the attorneys to be good. All titles come from the Government and are continued by the payment of the annual tax of ten pesos Chilean, per hectare (89c. per acre). Besides the mining claims, the company also owns about 35 acres of ground in the city of Rancagua, where the railroad terminal is situated, railroad right of way, right of way and water rights for the ditch line, power station, and power line.

The property had been worked by the Chileans for many years, operations being carried on in the Teniente mine and the rich hand-sorted ore either smelted nearby, transported to other Chilean smelters, or shipped aboard. Some concentration was done by means of hand-jigs on the richer grade of ore, but no attempt was made to operate on the low-grade ore found in the Fortuna mine. In April, 1904, the property was purchased by an American company, and in May, 1909, the present Braden Copper Co. acquired the ownership.

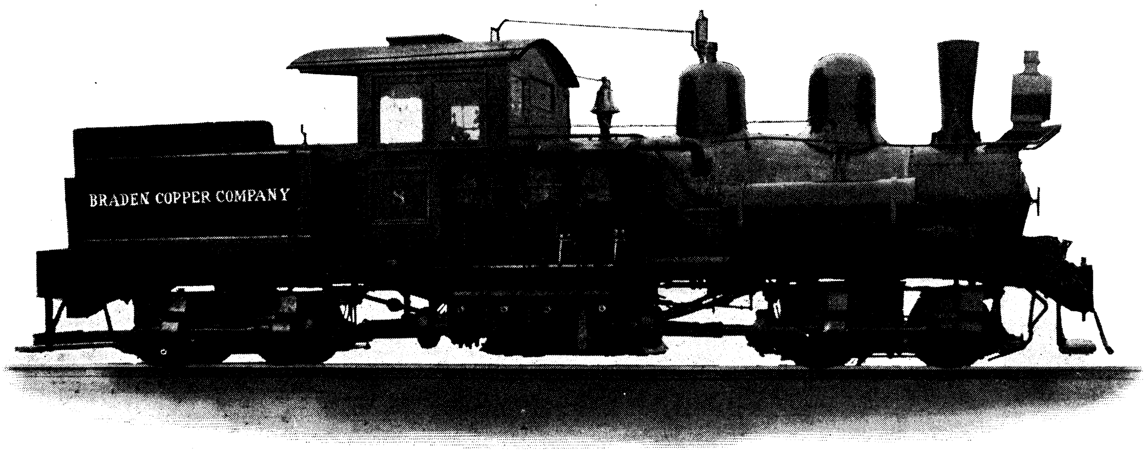
The mines are situated in a region of great ruggedness, on a part of the main range of the Andes mountains. All the rocks are eruptive. The country rock is andesite, surrounding a body of tuff, which represents the old crater of a volcano. The tuff, light gray in color, is no longer loose, but has been roughly cemented into a hard concrete-like rock mass. This represents material from a great volcanic outburst, which covered the old eruptive material by great thickness of volcanic ash, fragments of lava, and general ejectamenta. This is well known in the tuff and volcanic agglomerate forming the core of the crater, made up of volcanic material of different sizes in the shape of more or less rounded boulders and shattered material, down to the finest impalpable powder, resulting from the violent ejection of material, part of which fell back into the same crater and was thrown out again and again, thus becoming abraded by contact. Solutions may have had some effect in the rounding of the different fragments, but the principal cause was abrasion. It is close to the contact, but in the andesite, that the main orebodies occur. It may be mentioned, however, that a part of the Teniente deposit occupies an old fumerole in the tuff itself.

The volcanic vent is practically circular in horizontal section; though owing to the great denudation on the north side, the outline appears to be oval rather than circular. The diameter of the vent is roughly 4,000 feet and the periphery measured along the outside is about two and one-half miles. While in the main circular, there are many irregularities, due to the tuff filling breaks running out into the andesite. At numerous points around the rim of the crater, there are evidences of water sorting, giving a more or less sedimentary appearance to the tuff, and showing evidence of a probable crater-lake occupying the old volcanic basin. The slopes of the mountains are very steep; as much as 30 per cent is often found. There is practically no vegetation, and a large part of the slopes are so steep as to be devoid of slide-rock.

The water-shed is toward Teniente creek, which joins th Coya at the smelter-site; the latter stream joining the larger Cachapoal close to the power-site, eighteen or twenty miles distant. Geologically, the mountain range is young, having supposedly been formed during Tertiary times, and while volcanic and solfataric action has long since ceased, movements of the earth's crust are still general, as indicated by the not uncommon earthquakes.

The orebodies occur around the periphery of the crater in the andesite, at its contact with the tuff. These occurrences represent andesite, which is more or less shattered and near the contact of the tuff often considerably brecciated, carrying the copper minerals in the cracks and openings. The mineral was deposited after the time of great volcanic disturbances, "during the closing stages of igneous activity and is aqueo-igneous in development." The minerals making up the ore have been deposited from ascending hot solutions, mainly filling cracks or replacing some of the constituent minerals of the andesite. The richer portions are apt to be where the greatest brecciation is, except where the brecciated material has been closely filled with tuff, "originally in the form of mud forced into the interstices of the breccia as an emulsion."

In the case of the Teniente 'pipe', which represents an old hot-spring channel, the loosely agglomerated boulders of tuff and breccia have been coated by mineral, either deposited in open channels or replacing some of the tuff itself. Denudation of the surface has been in some cases more rapid than oxidation, and the sulphide zone often reaches to the surface. In the case of the Teniente pipe, however, oxidation has been carried to a considerable depth, and hence a good deal of mineral is secondary, there being considerable chalcocite and especially cuprite and metallic copper; these latter minerals being by no means so common in the Fortuna section.



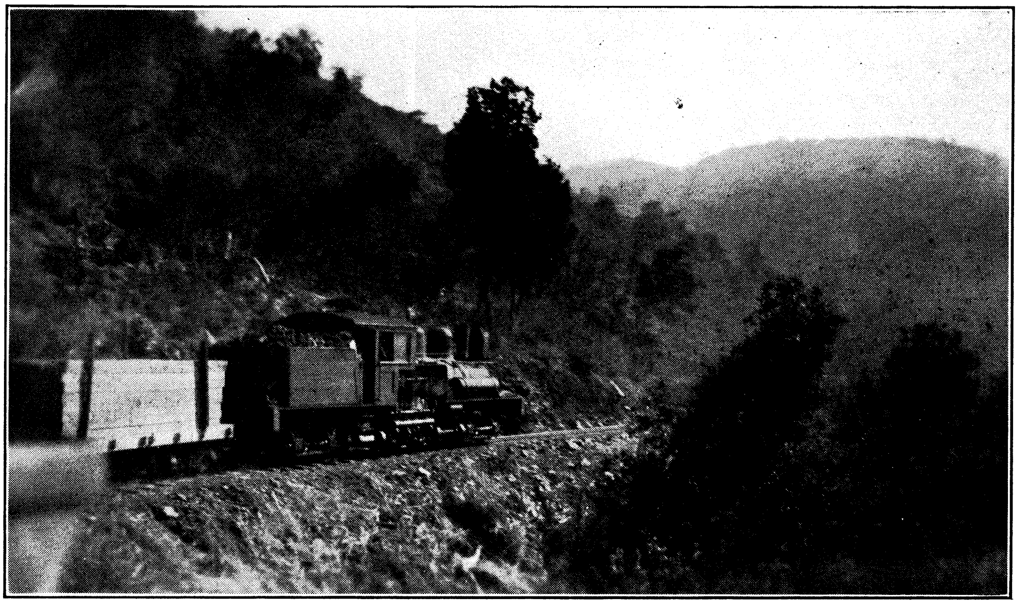
Shay Locomotive, 42-ton size, used on Braden Copper Co.'s railroad

The orebodies are limited on one side by the tuff, but in the andesite the line of division is, as a rule, poorly marked; instead of being determined by distinct planes the limit is determined rather by the commercial features. In other words, on passing from the brecciated material into the fractured andesite, the content of lopper becomes gradually less and fades out in the more blocky andesite country rock. The orebodies dip at about 70 degrees toward the centre of the crater. Three so far have been worked on: first, the Fortuna; second, the Teniente; and, third, what is known as the Fortuna No. 4. All of these showed strong outcrops, stained with copper minerals. Besides these strong indications are others, one to the east of the Teniente main workings; another the Soldado, farther to the east and south; and still farther south, the Caballeria No. 1 and No. 2, and the Rejimiento, and it is where these indications are shown that future development is planned.

In order, as carefully as possible, to gather all the geological facts bearing on the ore deposits, besides a careful study in the field, numerous samples were taken and submitted for microscopic examination; C. P. Berkey of Columbia University undertaking the work. I can say that Mr. Berkey corroborated my previously expressed views concerning the orebody, in the direction of continuation of commercial ore to a considerably greater depth and to the fact that the copper content is mainly in primary minerals rather than in secondary.

Metallic minerals are iron pyrite, magnetite, chalcopyrite, bornite, and secondary chalcopyrite, a mineral said to resemble tetrahedite and zincblende, in the sulphide zone; and in the zone of oxidation, limonite, cuprite, metallic copper, and the carbonates and silicates of copper. The principal non-metallic minerals, outside of the original constituents of the rack are, tourmaline, quartz, ankerite, calcite, chlorite, sericite, mica, epidote, and zircon.

The depth to which the profitable orebodies will reach is an important and naturally difficult question to determine with any degree of accuracy. The indications, however, point to a considerable depth, much greater than has been reached at the present time, and will be in the main limited by compactness of the rock and lack of fracturing, due to the great depth below the original surface at the time of the formation of the orebodies. The difference in elevation between the highest outcrop at Caballeria and No 4 level, where commercial ore is found, is about 2,500 feet.



Scene on Braden Copper Co.'s railroad. 41½% grade, train pulled by 42-ton Shay

The Teniente pipe, which has been followed to within 300 or 400 feet of the level of Teniente No. 3, showed open channels and indicated great freedom in the passage of the hot solutions. No. 4 Fortuna also shows open texture. However, the few evidences seen are invariably in favor of much greater depth, and as the value of the copper is due to its being mainly in the form of primary minerals, rather than secondary, much change in grade, due to increased depth, is not expected.

It may be said that while chalcocite does occur in the Fortuna, it is limited in amount and apparently occurs as a thin coating on pyrite and chalcopyrite, increasing the grade only in a small way. The Teniente pipe represents a different condition, for here there has been considerable secondary action, and the rich bonanzas have been mainly due to secondary cuprite, metallic copper, and chalcocite. At greater depth, the lower-grade minerals, chalcopyrite and bornite, will probably be reached, and instead of the bonanza of the upper worked-out portion, there should remain ore carrying bornite and chalcopyrite, but more concentrated than in the case of the Fortuna ore.

A thorough and careful geological survey was made of the deposits in 1910 by my assistant, Robert Marsh, Jr., with a supplementary study in 1911. Operations have been conducted

on three distinct orebodies, each one of which differs considerably from its neighbor, but all of which have points in common resemblance.

The Fortuna mine was originally opened in the search for rich ore, the strong copper stains of the outcrop leading the original prospectors to hope for high-grade ores similar to those found in Teniente. These prospectors opened up a considerable extent of ground, but reached no great depth, nor did they find much high-grade ore to pay for their labors. Their work, however, showed the American company what to expect, and led them to concentrate their efforts toward the development of this property.

The Fortuna orebody is typical and is represented by a body, lense-shaped in horizontal section, as far as developed, about 1,500 feet long, with a maximum width to 260 feet, and of an unknown depth, but so far developed to the No. 4 level, a distance of 1,321 feet below the upper part of this orebody. The ore lies partly in the fractured andesite and partly in the breccia. At the south end there seems to be a constricted area, where the bracciation and fracturing is less marked. It is hoped that in driving along the contact of the breccia and tuff, conditions may arise favorable to an enlarging of the constricted area into still another body. The second and third levels have been well developed by the main adits and by numerous cross-cuts and stopes. Both levels are being operated.

The ore of No. 4 Fortuna orebody occurs in a highly shattered zone of open texture with little or no fine cementing material. The copper is found mainly in the minerals bornite and chalcopyrite in well developed crystals associated with ankerite and quartz. The orebody is now being developed and has shown a length of 55 metres. The ore is being raised on and is still continuing at a height of 42 metres. The indications are good for considerale height of ore above the level, and a considerable depth.

The Teniente orebody outcrops in the crater of the old volcano and shows high-grade ore at the surface. The copper occurs in the form of malachite, azurite, chrysocolla, cuprite, metallic copper, bornite, and in the deeper workings, chalcocite. The old prospectors followed the bunches and stringers of ore in the 'pipe' and in seams running from the 'pipe' to a very considerable depth, but were finally driven out by water.

While the 'pipe' seems to have narrowed with depth, the ore is still said to continue. At the present time, however, the company has not been able to examine this below 150 feet below the No. 1 Teniente cross-cut. Above this the rich ore has been extracted, but there is still some concentrating ore, which it did not pay the old operators to mine. This ore, however, is considerably oxidited and will make a poor product for concentration, and will besides require a good deal of hand sorting. At greater depth, however, the oridation will decrease and more sulphides appear. The original concentration of high-grade sulphide was further enriched by secondary deposition from descending solutions.

The pipe, occurring wholly in the tuff and agglomerate, appears to be rudely shaped like an inverted cone. It has a dip of about 45 degrees northeast from the surface to the adit level; from there steepening to 70 to 80 degrees. The ore in the pipe so far mined has been largely secondary, and there has been considerable enrichment, due to the leaching of ore higher up and re-precipitation of the leached copper. The constitution of the material in the volcanic pipe being a loosely formed agglomerate, has allowed the free passage of solutions and has made possible oxidation at greater depth, due to descending waters, as well as easy passage for the original hot ascending solutions.

When the present company took possession of the property, the shaft below the No. 1 adit-level was full of water, and an attempt was made to unwater this, but without success. Since then, however, the shaft has been drained, probably through the approach of the No. 3 Teniente. Owing to the fact that the shaft was filled to half its depth with debris, the bottom of it has not yet been examined. It is to tap this that the No. 3 Teniente is now being driven, but that

adit will also be used to look for ore in the fractured andesite to the east and north of the old workings. A raise of about 300 feet will be necessary to connect the bottom of the shaft with the No. 3 Teniente.

For exacting the ore a modified caving system is being employed, and in preparing the mine for this work the stopes are started by the overhand method, the stopes remaining filled with broken ore on which the men work. Pillars are left between the stopes and these will afterward be caved or broken out. Previously cross-cuts were driven at distances of about 17 metres, centre to centre, and the centre line of the stope was then fixed over them. These stopes have a width of 9 metres, leaving a pillar of 8 meters between. The major axis of the stope was at right angles to the contact. Where the lens was not very wide, a stope was made, running in the direction of the length of the lens, rather than across it. The ground stands well and breaks well, and no timber is required except where box holes are made.

In the past, ore from No. 2 and No. 3 Teniente was carried down by two separate aerial tramways to the main loading station, from whence it was taken by another aerial tramway to the concentrator. No. 4, 3 1-2, 3 and 2 Fortuna are connected by raises and all ore will be dropped down to the No. 4 level and loaded into cars, and from there transported to the ore-bins supplying No. 5 level, from which it will be carried direct by electric tramway to the concentrator. The Teniente mine will also connect through No. 3 Teniente, No. 1 cross-cut, and No. 4 Fortuna with the main ore-bin in No. 5 Fortuna.

A very careful measurement of the tonnage of ore developed and the value of the same has been made, and the following is a summary, as at July 1, 1911:

	Tons	Per cent Cu.
Main Fortuna orebody, to 30 metres below No. 3	7,077,986	2.90
Additional ore developed by No. 3 1-2 up to June 10, 1911	2,721,808	2.70
Fortuna No. 4 orebody	212,312	3.58
Tenienta No. 3	62,510	3.38
	10,074,616	2.85
		say 2.70

In the past stoping was done mainly by hand, but it is proposed to carry this on by small hammer-drills. Driving is done by air-drills and by hand, but when in full operation, machine-drilling will be almost exclusively employed. No hoisting of ore will be necessary, as the ore-bodies can be more easily reached through adits. Ventilation will also be easy, and there should be no trouble on account of water, as all draining will be done through the different adits. Still greater depths can be reached by longer adits. For instance, an adit about 6,000 feet long driven from a point close to the mill would tap the Fortuna orebody at a depth of between 800 and 900 feet below No. 4 adit, the deepest ore now developed.

No 3 1-2, to judge by development already proved on that level and levels above, should open up another two and a half million tons. No. 4 Fortuna has also shown commercial ore below No. 3 1-2, but development has not progressed far enough to allow estimate of grade. It promises well and will add greatly to the tonnage. The grade so far encountered is commercial, though not as high as the average on account of being on the foot-wall side of the orebody. Roughly, about 1,500,000 tons may be considered as partly developed by No. 4, September 1, 1911.

In determining the results, ore running less than 2 per cent copper was excluded. It has been figured that ore even as low as 1.5 per cent will give a profit at 12 1-4c. copper. The density of the ore was determined and 12 cubic feet in place was found to be equivalent to one ton in weight.

In determining Fortuna No. 3 1-2, 100 feet below the level was included. For the No. 4 Fortuna orebody, allowance for a block of ground extending 50 metres above and 15 metres be-

low the present level was made. No ore is considered as developed in No. 1 Teniente. Teniente No. 3 is all 'probable ore.' No allowance is made for any ore in the old portion of the Teniente, although undoubtedly considerable will be recovered from the old workings. Nothing, of course, has been considered in connection with the Soldado, Capitana, Caballeria No. 1 and 2, or Rejimiento.

Careful sampling has been done by the mine management and this has been satisfactorily checked by individual engineers—namely, Harold A. Titcomb, J. A. McCaskell, and Allen H. Rogers. Sampling was done at comparatively short intervals, and these intervals, considering conditions, have proved to be sufficiently close. The ore is so homogeneous in different sections that even a poor sampler would be expected to get approximately the same results as a more expert one, and to this homogeneity of the porphyry ores has been due the close agreement as to assay values by different engineers making an examination of the porphyry properties in the state.

The future 'possibilities' for ore are most promising—first, in the direction of new orebodies, indicated in the several copper-stained outcrops around the periphery of the crater; second, in the very promised ground along the contact, close to the old Teniente workings; third, the most important of all, the continuation of the present developed orebodies, main Fortuna and No. 4 Fortuna, to considerable depth. The belief in this continuation is based, first, on the geological features to which the formation of the orebody is due, namely, the formation of the ores from ascending solutions rising from considerable depths, just after the violent volcanic disturbances; and secondly, to the fact that most of the copper minerals from which the deposits obtain their value are essentially primary, to the extent of their dating back to the original process of silicification and mineralization accompanying igneous activity. The copper minerals occur more as vein fillings than as replacements of original rocks, and are not dependent upon secondary enrichment from downward percolating solutions, which have leached out the copper minerals at higher horizons and redeposited the copper in mineral form, and thereby enriching the poorer primary ores.

It is interesting to note that the ore shown on the second level of the Fortuna is practically of the same assay value as that on the No. 3 level, though the latter is 275 feet lower than the former; and No. 3 1-2 averages little lower than No. 3, though 328 feet deeper. Assays for this level so far show an average of 2.56 per cent. No. 4 Fortuna orebody is at a much lower geological horizon, but shows even higher content, due probably more to local conditions than to anything else. The Teniente pipe will probably show a lower content in depth than in the upper portion, where there is considerable secondary enrichment, due to cuprite, metallic copper, and secondary chalcocite. Later development in No. 3 1-2 and No. 4 Fortuna seems to show an extension of the ore toward the east, which will bring in an increased tonnage of lower-grade ore. The raise from No. 4 to No. 3 1-2 has shown a considerable area of low-grade ore extending beyond the main body.

At the mine, offices, store, quarters for the foreign employees, and for the native workmen, have been erected. The native miners are mostly quartered at the different adits in large rooms, cut out of the country rock, there being no place to erect buildings nearby on account of the steep rocky slopes. At the No. 4 level is situated the compressor plant and electric station, operated by power from the Cachapoal power-plant, and here also are the blacksmith and repair shops.

Supplies have been borught to the mine either by wagon or by aerial tramway, and on this latter the ore is carried to the mill. Later, however, transporting will be done by electric trolley line, run from No. 5 adit to the top of the ore bins at the concentrator, and this trolley line will be connected with the main railway by an incline at the east end of the concentrator. Water for all domestic purposes is obtained from Teniente creek, which is ample for all requirements.

Underground haulage is at present done by means of small cars, either pushed by hand or hauled by horses. Arrangements have been made, however, for electric traction, and electric loco-

motives and cars are on the ground, and large electric locomotives are to be employed to transport ore from the No. 5 adit main ore-pockets to the top of the concentrator, over a line about three kilometres long.

Owing to the numerous snowslides, it was naturally felt that a surface line would be dangerous, but after looking over the ground very carefully, it is believed that the proposed line will be better than aerial trams, but snow-sheds have been erected to avoid the danger from delays caused not only by slides but by drifting snow.

From a close study of the ore and from experience in the treatment of somewhat similar ore in Nevada and Utah, plans have been made for a concentrator, and the plant is now under construction. It is designed on lines somewhat similar to the Utah and Nevada pants, but with coarser preliminary crushing and with the introduction of jigs to catch the coarse mineral. The plant is designed for crushing with gyratory crushers and rolls, screening by means of shaking-screens; treating the product on roughing and cleaning jigs of the Woodbury type, regrinding the tailing in Chilean mills, classifying the finer sizes, and treating same on Wilfley tables and Frue vanners. The concentrate will be deivered either to the smelter or to the roasting plant, should leaching of the concentrate be decided on.

The coarse-ore bins will have a capacity of about 1,400 tons. From the bins the ore will be carried on belts to the crushers, of which there will be two No. 7 1-2 gyratories, two 48-inch rolls, and six rolls of 36-inch diameter by 15-inch face. From the crusher station the ore will be delivered by belts to the fine-ore bins, about 4,000 tons capacity, and from these by belts to the mill itself.

The concentration will be done in two separate mills, the first of three units, each unit having a nominal daily capacity of 533 tons. The second concentrator represents an enlargement and re-design of the present concentrator. It will have a nominal daily capacity of 400 tons. These two mills will be brought up to a daily capacity of 3,000 tons. The mill has been designed so as to allow for expansion at either end if plant is increased.—Mining and Scientific Press.

IMPROVING THE HIGHWAYS

Until automobiles became numerous, there was very little sentiment in the United States to favor the improvement of country roads. The only interests demanding improved highways were farmers and they failed everywhere to carry on combined efforts so their influence was unfelt. The most important performances on road improvement were carried out by railroad companies in the mending of roads that country produce could be carried over on its way to railroad shipping points.

Since automoiles became numerous constant agitation has been worked up favoring improved highways and the results have been marvelous. Figures compiled by the office of Public Roads of the Department of Agriculture in Washington, show that the expenditures in the United States for improvements on roads have more than doubled since 1904. In 1904 expenditures for this purpose amounted to $79,771,417, while in 1912 the total was $164,232,265, or an increase of $84,450,945.

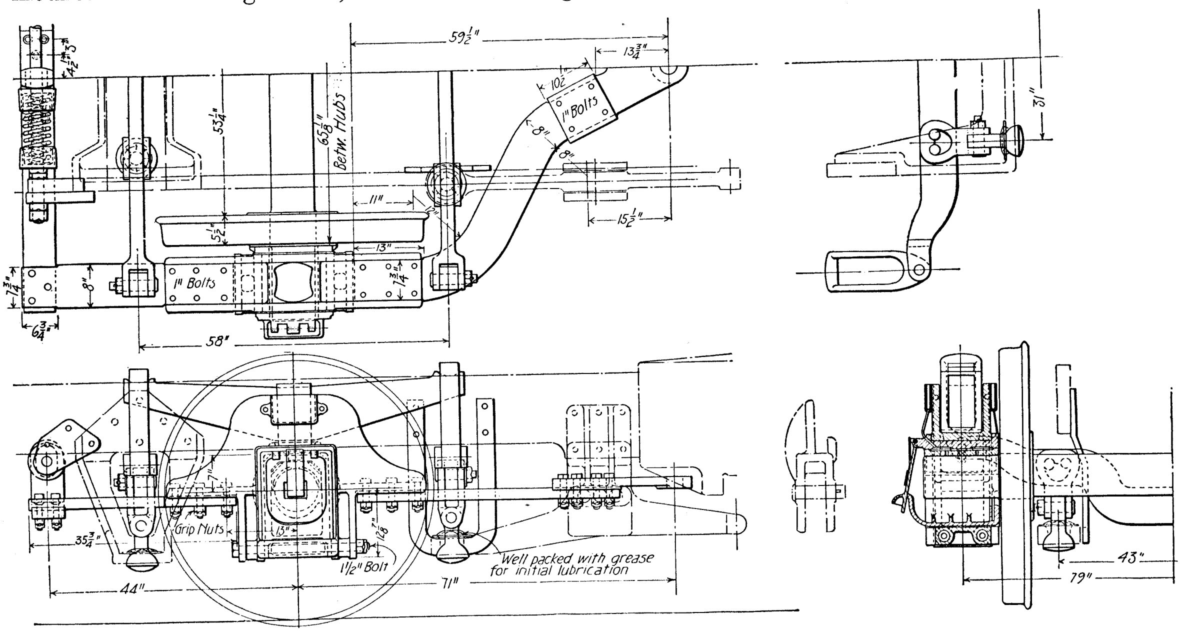
It is shown that the greatest progress in road construction took place in those states that aided in the work by appropriations out of their state funds. In 1904 there were thirteen states that contributed $2,607,000, while in 1912 there were thirty-five states that appropriated to the extent of $43,757,438.

The expenditures for this purpose in 1912 amounted to $74.65 per mile, which was double that of 1904, when the per mile outlay was $37.07. The states having the largest expenditures for state aid and trunk line roads in 1912 were: New York, $23,000,000; Pennsylvania, $4,000,000; Maryland, $3,370,000, and Connecticut, $3,000,000.—Railway and Locomotive Engineering.

AUSTIN IMPROVED TRAILING TRUCK FOR LOCOMOTIVE

Description of an improved type of trailing truck for locomotives of the Pacific, midako and similar types, and recently applied by the Lima Locomotive Corporation to Pacific Mountain type locomotives for the Great Northern Ry.

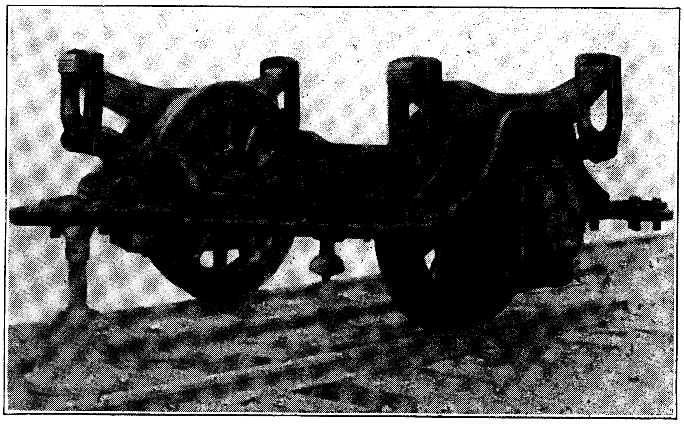
The Lima Locomotive Corporation, Lima, Ohio, is supplying the Austin improved trailing truck on engines of the Pacific, mikado or similar types, as a features exclusive with this manufacturer. This truck, the construction of which is shown by the accompanying illustrations, was designed with a view to improving the action and maintenance of trucks applied as trailing wheels. The component frame members, which may be identified by reference to the drawing reproduced herewith, are simple and easily assembled. The frames, right and left, are interchangeable and reversible. The radius bar is made in heavy rectangular section and is well attached to a separate cast steel radial hinge. The rear end of the framing is composed of two side bars adjoining the cast steel frame and a cross bar connecting transversely. On this bar is mounted a centering device, but this centering device is unnecessary and can be omitted if desired,



The Austin Trailing Truck for Locomotives, Lima Locomotive Corporation

the features of the truck being so arranged that "gravity centering" is accomplished through the medium of the heart-shaped links which are component parts of the suspension cradles, both front and back of the wheels.

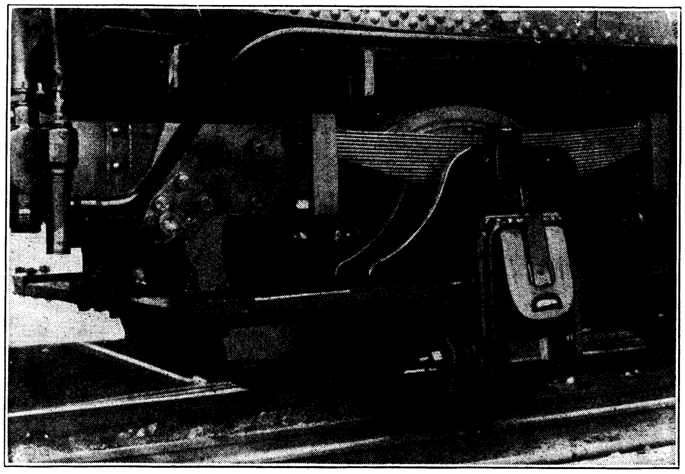
These suspension cradles consist of cross equalizers as illustrated. The rear cradles are attached to the outside spring hangers and in turn suspended from a positive fulcrum by the heart-shaped links which are somewhat in the form of universal couplings. The lower portion of these links has a spherical head which allows twisting movements in all directions and also allows the transverse radial motion for the entire cradle. The first knuckle joint above these spherical ends allows a fore and after movement, so that when the truck radiates the apparent lengthening and shortening of the side members is fully accounted for. The transverse movement of the cradle is governed at the bottom by the spherical head, but at the top by two pins connecting the heart links with the cradle. These pins give a positive bearing while the engine is on a straight track and assure stable equilibrium on account of their three points suspension effect. When transverse movement on the cradle occurs, the heart links radiate from one or the



Austin Trailing Truck

other of their pins, according to the direction of movement and always tend to recenter by falling back on the double pins; the condition of the link while raised on one pin being always one of unstable equilibrium. The truck is thus a gravity suspension truck, and is similar in its action to any other positive heart-shaped link, such action being well demonstrated by front trucks having this type of olster suspension.

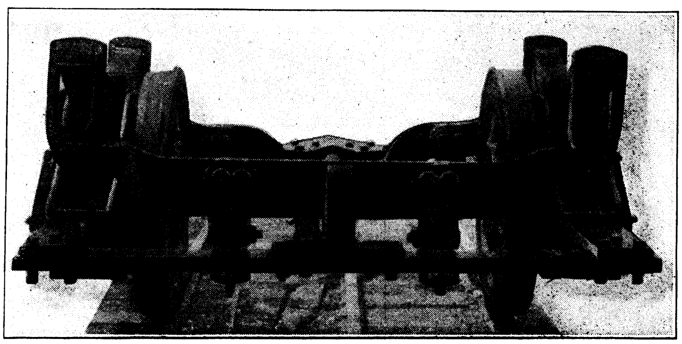
By the employment or this truck, the rear end of the engine is held in alignment with the drivers by the force of gravity instead of being held by the more or less capricious action of helical centering springs. The cradle on the front of this truck is essentially the same as the one described at the rear, except that it connects with the driving equalization through the medium of the equalizer located at the back of the rear driver. Particular emphasis is placed upon the fact that this cradle is not restrained by any jaw or contrivance on the frame and is therefore subject to no tendency to nip off outside the frame.



Austin Trailing Truck as applied to locomotive

When this truck acts on a curve there is very litle angular stress on any one component member of the cradle construction, as transverse flexibility occurs not only at the spherical end of the heart link but also at the top or centering end and again at the outside connection of the cradle to the spring hanger. These trucks have been observed on 23-deg. curves, and their action, it is stated, is remarkable in this particular, the compensating effect of the members of the cradle being particularly noticeable. The angular position of any one member is slight, as the component members of the cradle adust themselves in the manner described.

To remove the wheels and axles from trucks built with integral boxes, the box must be entirely dismantled; and to remove the box itself for purposes of replacement and repair, the framing structure of the truck must be separated because the box is also a part of the framing. Removal of wheels and axles not only involves the removal of component parts of the truck, but frequently of auxiliary pedestal tie bars which exist on false pedestals on the engine frames. The Austin truck has a separate journal box fitted in a cast steel



Austin Trailing Truck

frame and this box can be removed from the frame without further dismantling the truck. It is merely necessary to remove the pedestal tie at the bottom of the jaw holding the box in the frame, and the boxes, wheels and axles can be dropped or removed by the usual processes of jacking or lifting. The box itself is comparable to a large sized tender box and can be handled in much the same manner. It is of less weight for handling during shipment or in carrying to a machine. The first casting is also of less weight in the foundry. This box is fitted with a spring lid. The brasses fitted to this truck are usually of the "collarless" variety, somewhat similar to a large tender brass, and they can be made of any dimensions suitable for the weight carried. Wheels, axles and journal brasses can be made to interchange with those used on any of the other well-known types of trailing trucks.

The journal box is oiled in the usual manner by packing placed in the cellar below the axle. It also has an oil cellar located on both inside and outside frame members, the inner oil cellars serving to oil the hub of the wheel where it bears against the box and the outer cellar serving as an auxiliary oiler for the crown brass. This latter is particularly valuable when breaking in a new journal. The cellar is also fitted with a felt guard.

One of the points of improvement advanced for the Austin truck is that the radius bar is so arranged as to be approximately on the center line with the thrust against the axle and thus greatly improves the strength of the structure. Radius bars on other trucks are sometimes broken because of the low position of this radius frame which passes under the box and which increases by its leverage action the stress due to reaction against the center of the axle. The truck has a strong steel frame rigidly fastened to the radial bars and in no wise dependent on the thimble tie below the frame, this thimble tie having for its sole function the retention of the box in its jaw.

The engine frame construction used with this truck is of the simple slab variety and has no auxiliary pedestal or pedestal binder below the axle which must be removed when assembling the truck. Pedestal binders of this description are found on the bar frames used with some trailing trucks and they serve no useful function except to bind the structure of the framing itself. Such a trussing or binding effect, it is claimed, is not necessary with a slab frame forged from a solid steel billet and practically in line with the pull of the drawbar.—Railway Review.

SCIENTIFIC FIRING

There is constantly pouring into railroad service a fresh stream of locomotive firemen composed mostly of young men who wish to become expert firemen. For reasons not difficult to explain, we frequently receive applications from these young men, for information concerning the art of firing, and it affords us pleasure to select the best books within our reach, and these are numerous, so that inferior firemen are not deficient in skill for want of good instruction. As firing is our theme we will venture to place before our readers a few words on scientific firing.

To properly comprehend what happens to keep a fire burning we must understand something about the laws of nature as they are explained under the science of chemistry. Practical men are generally easily repelled by the strange names which they meet with in reading anything where chemical terms are used. An engineer or fireman who is ambitious to learn the principles of his business ought to attack the hard words with a little courage and perseverance, when it will be found that they are not nearly so difficult to make out as first they appeared to be.

A man may become a first-class fireman without knowing anything about the laws of nature that control combustion. If he becomes skillful at making an engine steam freely while using the least possible supply of fuel, he has learned by practice to put in the coal and to regulate the admission of air in a scientific manner. That is, he puts in the exact quantity of fuel to suit the amount of air that is passing into the firebox, and in the shape that will cause it to produce the greatest possible amount of heat. This degree of skill is often reached by men ignorant of nature's laws; but it is attained by groping in the dark to find the right way. A man who has acquired his skill in this manner is not, however, perfectly master of the art of firing, for any

change of furnace arrangement is likely to bewilder him, and he has to find out by repeated trying what method of firing suits best. He is liable at times to waste fuel uselessly, or to cause delay by want of steam when anything unusual happens.

A knowledge of the laws of combustion teaches a man to go straight to the correct method, and the information gained enables him to deal intelligently with the numerous difficulties which are constantly arising through inferior fuels, obstructed draft due to various causes, and fireboxes badly designed.

The nature of fuel, the composition of the air that fans the fire, and the character of the gases formed by the burning fuel, and the proper proportions of air to fuel for producing the greatest degree of heat, are the principal things to be learned in the study of the laws relating to combustion. The air above, the earth beneath and the waters under the earth, are all composed from about sixty-five elementary substances which have combined together to form the immense variety of substances found in and around the globe.

The elements which perform the most important functions in the act of combustion are oxygen and carbon. Carbon is the fuel, and oxygen is the supporter of combustion. Combustion results from a strong, natural tendency that oxygen and carbon have for each other, but they cannot unite freely till they reach a certain temperature, when they combine very rapidly with violent evolution of light and heat.

The fireman who studies the scientific principles of his business finds the work much more interesting than the man who merely thinks of throwing in enough coal to keep up steam. All the operations connected with the management of a locomotive are highly interesting to the man who loves his work. Nearly all occupations have attractive features peculiar to themselves, but we think from years' experience in the cab that the work of firing and running a locomotive is the most alluring within a range of wide experience. But to obtain the real enjoyment constant study of the work is necessary.—Railway and Locomotive Engineering.

Marathon Lumber Co.'s New Mill at Laurel, Miss.

(Continued from page 2)

made for the drying of its product. It will have a battery of seven moist air kilns, each 104x20 feet, furnished by The Standard Dry Kiln Co., of Indianapolis. These kilns are the last word in type and construction, embodying every modern improvement, including "The Standard" steel post foundation, door carriers, etc.

The Marathon Lumber Co., it is understood, is controlled by the same interests as the Wausau Southern Lumber Co., of Laurel. The selection of "The Standard" kiln for the new Marathon plant came as a result of the thorough test given this make of kiln at the Wausau Company's mill, where five "Standard" kilns were installed two years ago. A year later two more of the same kilns were added. The seven kilns now to be installed at the new plant will give these two mills a combined battery of fourteen "Standard" kilns.

They will operate a logging railroad, and have ordered two new 42-ton Shay locomotives from the Lima Locomotive Corporation, as well as a large Mogul locomotive for their main line work.

AMERICAN HOIST & DERRICK CO.'S SEATTLE BRANCH IN NEW QUARTERS

The Seattle office of the American Hoist & Derrick Co., has been moved from 613 Western avenue, to 1512 L. C. Smith building. The L. C. Smith building is one of the highest and best equipped office buildings in the country and its central location will be more convenient for out-of-town customers.

The American Hoist & Derrick Co., maintains in Seattle a full line of hoisting machinery and repairs and the quality of service rendered by it to coast customers has won much well-deserved praise.

Mr. F. R. Schoen, a man brought up in the hoisting machinery business, has charge of the Seattle office.

GREATEST COKE PRODUCTION

All records in coke production in the United States were broken in 1913, according to a statement by Edward W. Parker, of the United States Geological Survey, the output being 46,311,369 net tons, valued at $128,951,430. This is an increase over the 1912 output of 2,327,770 tons in quantity and $17,146,317 in value. Of the 1913 production 33,596,669 tons was made in bee-hive ovens and 12,714,700 tons, or 27.4 per cent., in by-product ovens. The increase in production of by-product coke was over twice as large as the increase in bee-hive coke.

The principal increase in by-product coke production in 1913 was in Alabama, where the gain was nearly 50 per cent.—from 1,349,797 net tons in 1912 to 2,022,959 in 1913. The increase in Pennsylvania was nearly one-third—from 1,974,-619 tons in 1912 to 2,628,680 tons in 1913. Indiana showed an increase of 110,686 tons and Illinois of 94,609 tons.

A large part of the coal used in by-product ovens in States that do not produce coking coal was obtained from West Virginia mines. Mr. Parker estimates that the quantity of West Virginia coal made into coke outside of the State was 7,800,000 net tons. The quantity of coal made into coke in West Virginia was 4,034,251 tons and the quantity of coke produced therefrom was 2,472,752 tons. If all the coke made from West Virginia coal were credited to that State it would amount to about 7,750,000 tons.—The Iron Age.

ARE NARROW GAGE LOGGING ROADS ECONOMICAL?

Of the logging railroad mileage of the United States a considerable percentage is of a gage less than standard—some of it 3 feet and some 42 inches, with other odd widths. Initial cheapness of construction has been in most cases the determining factor. In some instances narrow gage railroads are used where the cost of building a wider roadbed would be tremendously greater, as is true of many Colorado mountain roads, but these conditions do not usually obtain in logging railroad practice.

F. Lavis read in interesting paper on this subject at a recent meeting of the American Society of Civil Engineers after having made a thorough investigation of the problem of railroad construction as applied to Argentina. He reports that the cost of construction of the standard railroad is so little more than that of a narrower gage that it is much more than counter-balanced by economy in operation. This author states that any curve practicable on a norrow gage railroad may also be applied in standard gage practice, although the train resistance and rail wear are of course greater on the broader gage. Owing to the lessened stability, however, a narrow gage road requires a better roadbed in order to keep the cars on the track, and in logging road practice this is a matter of some importance. In Argentina the net earnings on capitaliaztion of the narrow gage railways are only about half as much as of the standard gage lines, notwithstanding the capitalization per mile of the broad gage road is necessarily greater.

The building of narrow gage trunk line railroads in the United States was at its maximum in the early '70s, following the Civil war, when capital for railroad improvements was hard to secure. A good narrow gage railroad will stand heavier traffic and higher speeds than was originally believed, and yet its disadvantages as compared with broad gage practice have become more evident and it is now clearly seen that it can not begin to carry its traffic at as low a ton-mile cost as standard construction.—American Lumberman.

NOT A BAD ONE

A Scotch man had met with an accident, by which his breast-bone had been forced inward to such an extent that his breathing was impeded, and his death in consequence quite imminent. Nothing could be done for him, and he was told so. Just at that moment an itinerant Highlander commenced to play his bag pipes in the street below. The patient begged as a dying request, that the player might be brought up to his bedside, that the last sound in his ears should be the pibroch of his clan. The doctors consenting, the minstrel was brought into the ward, and blew for all he was worth, the pipes skirling and screaming. The dying man gave such a tremendous sigh that the effort expanded his chest, putting the breastbone back to its normal state. Doctors and nurses were all delighted, and congratulated the man on his marvelous recovery. They then turned to the other patients. They were all dead.—Ideal Power.

Changes in Boiler Inspection Rules

The recommended changes and additions in the Boiler Inspection Rules, as published in the Railway Age Gazette of May 15, on age 1066, have been approved by the Interstate Commerce Commission, and made effective on and after July 9, 1914. In connection with this the Special Committee on Relations of Railway Operation to Legislation in Bulletin No. 62 has published the following interpretations and rules made by the sub-committee of mechanical officers:

Rule 2.—119. Application for extension of time under this rule to be made by individual railways affected.

Rule 10.—120. The removal of superheater tubes every three years will not be required provided the tubes are in good condition, and the boiler can be thoroughly cleaned and inspected without their removal.

Rule 21.—121. All work required to be done monthly should be done when the boiler is taken out of service for inspection. Staybolts should be tested the same day the boiler is washed or before it is returned to service.

122. If staybolts, which are behind brick work on oil burning locomotives or behind grate bearers, have a tell-tale hole three-sixteenths inch in diameter their entire length which is kept open at all times, the removal of the brick work or grate bearers each month for the purpose of hammer testing such bolts will not be required. This will not, however, relieve from making a thorough inspection each time the brick work is removed, nor will it relieve from removing the brick work for an inspection when necessary.

Rule 52.—123. This rule effective January 1, 1915. Until that date quarterly cards, Form No. 2, may be used if in stock. Cab cards need not be certified to.

Rule 54.—124. When any locomotive is condemned, scrapped or sold, a final report on Form No. 3 giving both locomotive and boiler number should be filed with the district inspector. This should be certified to by the chief mechanical officer, or mechanical engineer. Further reports for such locomotive need not be filed. If boiler only is scrapped, and locomotive continued in service with new boiler, report should so state.

Rule 52.—Interpretations 72 and 73 are withdrawn as obsolete.—Railway Age Gazette.

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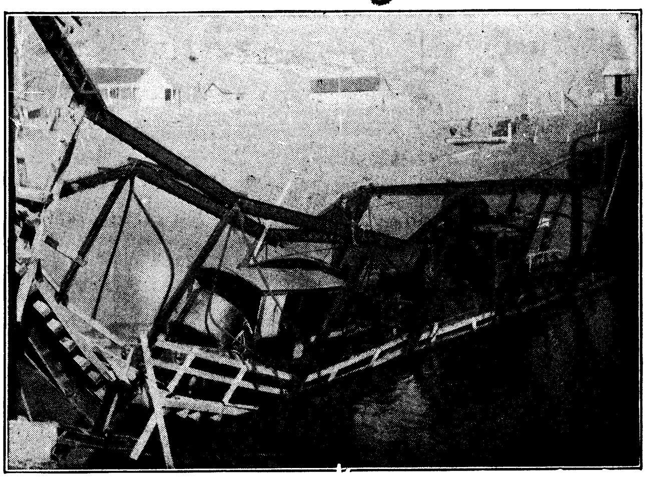
INDEX TO ADVERTISERS AND WHAT THEY HAVE TO SELL

A Triumph of Durability
"American" Log Loader falls 75 feet—few repairs required



The durable construction of "American" Log Loaders makes them practically accident proof. They not only bear up well under the hard knocks of the average day's work, but come through serious accidents with trifling repair expense. One "American" Loader operator tells us that he lost just 45 minutes last year on account of repairs.

An "American" Log Loader will not only load logs faster and more economically, but build all your logging road, making cuts and fills, driving piles and laying track. It will even set the heavy timbers and machinery of your mill—and it will never break down and tie up your whole operation. YOU CAN BANK ON THAT!

American Hoist & Derrick Co., St. Paul, Minn.